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Chapter 1 Introduction

This volume of *California Water Plan Update 2013* (Update 2013) presents a comprehensive and diverse set of 30 resource management strategies (RMSs) that can help meet the water-related resource management needs of each region and the state. In Volume 1, Chapter 2 describes the importance of regional planning and presents general considerations for preparing integrated regional water management (IRWM) plans and integrated flood management plans that are sustainable and suitable for each region's unique character. Chapter 5 of Volume 1 emphasizes the need for decision-makers, water and resource managers, and land use planners to consider uncertainty, risk, and sustainability in planning for California's water future. The *Regional Reports* (Volume 2) discuss how the 12 regions of California are selecting, combining, and implementing RMSs. The 30 RMSs described in this volume can be combined in various ways to meet the water management goals and objectives of the California Water Plan.

The RMS narratives are written by subject matter experts from the State agencies that sit on the Water Plan Steering Committee, with considerable input from other experts and stakeholders. The RMSs have been vetted in public workshops and during several rounds of public comment.

Update 2013 has undertaken additional analyses on the costs and results of doing packages of RMSs in the Central Valley under different growth and climate scenarios. These analyses of RMS packages provide policymakers and resource managers more quantitative information on the performance of various strategies, interactions between strategies, tradeoffs, and potential groupings of strategies. Update 2013 considers several different future scenarios that can be used by planners to test the performance of alternative strategy mixes.

Resource Management Strategies

An RMS is a technique, program, or policy that helps local agencies and governments manage their water and related resources. For example, urban water-use efficiency is a strategy to reduce urban water use. A pricing policy or incentive for customers to reduce water use also is a strategy, as described in the Economic Incentives RMS. New water storage to improve water supply, reliability, and quality is another strategy. Three new RMS chapters have been added for Update 2013 — “Outreach and Engagement” (Chapter 29), “Sediment Management” (Chapter 26), and “Water and Culture” (Chapter 30) — and are listed with the other strategies in Table 1-1, “Resource Management Strategies.” The 30 strategies are organized alphabetically under eight categories in the table, which describe their primary objective and emphasis while recognizing interdependencies among many of the strategies. A category and narrative is included in this volume for Chapter 32, “Other Resource Management Strategies,” which describes six subsidiary or emerging strategies. Additionally, Navigation was identified as another RMS, but because of limited time and resources for Update 2013, adding a narrative will be considered for California Water Plan Update 2018.

The RMSs can be considered as tools in a toolkit. Just as the mix of tools in any given kit depend on the job to be accomplished, the combination of strategies will vary from region to region, depending on climate, projected growth, existing water system, environmental and social conditions, and regional goals. At the local level, it is important that the proposed strategies complement the operation of existing water

systems. Some strategies may have little value in certain regions. For example, because of geology, the opportunity for groundwater development in the Sierra Nevada is not nearly as significant as in the Sacramento Valley. Other strategies may have little value in particular conditions. For example, precipitation enhancement may not be effective during droughts. Water managers at different geographical scales will have different perspectives on the assortment and cost-effectiveness of RMSs for meeting the needs and priorities of the locality or region, or statewide.

PLACEHOLDER Table 1-1 Resource Management Strategies and Management Objectives

[Any draft tables, figures, and boxes that accompany this text for the public review draft are included at the end of this chapter.]

Planning a Diversified Portfolio

The new and continuing challenges of California’s diverse and extreme conditions require local agencies to use new and different methods of managing water. Growing population, urban development patterns, global crop markets, changing regulations, and evolving public attitudes and values are a few of the conditions that water managers must navigate. Integrated water management (IWM) relies on a diversified portfolio of water strategies to achieve multiple and sustainable uses and benefits while balancing the risks of an uncertain future. Adapting to and mitigating climate change impacts have become increasingly important factors in selecting and implementing a package of RMSs.

RMSs are the tools that local agencies and governments should consider as they prepare their IRWM plans (see also Volume 2, *Regional Reports*). The intent is to prepare plans that are diversified and resilient; satisfy regional and state needs; meet multiple economic, environmental, and societal objectives; include public input; address environmental justice; mitigate impacts; protect public trust assets; and are affordable. Additional actions for planning and implementation can be found in Volume 1, Chapter 8, “Roadmap For Action.”

Organization of Resource Management Strategy Chapters

Although the chapters were written by different experts, the narrative for each strategy is organized similarly. Each includes the following elements and sections:

- Short definition of the strategy.
- The current use of the strategy in California, including an overview of what is happening today and background on the strategy. In addition, the strategy narratives recognize the relationship of water, energy, and other resources; consider climate change scenarios; and, as appropriate, articulate related resource policies, programs, and legislation.
- “Potential Benefits,” which includes a discussion on how strategy implementation will benefit water supply; drought preparedness; flood management; water quality; energy; environmental/resource stewardship; and other water management objectives, regionally and statewide, by 2030. Since the application of these strategies can vary widely among regions, as described in Volume 2, the strategy descriptions are from a broader, statewide perspective. More detailed information on some of the strategies is also presented in Volume 4, *Reference Guide*.

- “Potential Costs,” which includes estimates of implementation costs statewide by 2030 and unit cost information, when available. In most cases, costs are highly dependent on where they are incurred and can only be estimated broadly in these brief narratives.
- “Major Implementation Issues,” which discusses the tradeoffs, challenges, and considerations associated with implementing each strategy. For instance, with ocean water desalination there are issues involving water intake and brine disposal. Each RMS discusses mitigation for and adaptation to climate change.
- “Recommendations,” which discusses how the strategy could be implemented more effectively and efficiently over the next 30 to 40 years to address the implementation issues and promote additional implementation. Many of the recommendations are for State government to provide technical support to help regional groups make better decisions on the use of the strategies. The individual strategy narratives generally do not include specific recommendations for funding of individual strategies, though that discussion has been incorporated into Volume 1, Chapter 7, “Finance Planning Framework.”
- Cited and additional references, including Web sites where some of the source materials can be found. In other cases, the sources involve documented personal communications.

Although the RMSs are presented individually, they can complement each other or accomplish different goals. For instance, water from a recycling project could contribute to ecosystem restoration and groundwater recharge, while water use efficiency might reduce the opportunity for recycling and reuse. In some cases, implementation of an RMS may conflict with other resource management goals. Some of the strategies may reduce energy demand, while others may increase energy demand.

Strategy Summary Table

Table 1-2 provides a summary of the potential benefits and costs for the 30 RMSs in Volume 3, as well as several essential innovation actions and support activities, organized in the following way:

- **Left column.** Shows the RMSs that are available to help regions achieve various water management objectives.
- **Center columns.** Show potential strategy benefits that can be achieved by implementing a particular strategy. The table shows icons where the RMS narratives indicate that the strategies could have direct and significant benefits for water management objectives. Note that most RMSs can help achieve multiple benefits.
- **Right column.** Shows cumulative implementation-cost information in billions of dollars to achieve the indicated benefits or perform a support activity by 2030. Note that descriptions for each cost estimate are contained in the strategy narratives; the assumptions vary per strategy. The financing of RMS implementation is discussed in Volume 1, Chapter 7, “Finance Planning Framework.”

Benefit dots in the center columns can be viewed either horizontally for a given RMS or vertically for a given water management objective.

While most of the RMSs have multiple potential benefits, any individual site-specific project or program within an RMS may contribute only one, or perhaps a few, of the benefits. For example, it is unlikely that the agricultural lands stewardship practices on a single farm will contribute to all the potential benefits (as

indicated in Table 1-2). In aggregate, however, the combined agricultural lands stewardship practices on many farms can contribute to all of the water management objectives, as shown in Table 1-2.

PLACEHOLDER Table 1-2 Resource Management Strategy Summary

[Any draft tables, figures, and boxes that accompany this text for the public review draft are included at the end of this chapter.]

As part of the strategy narratives, the subject matter experts have indicated when strategies can provide significant water supply benefits, which may include water supply increases and water demand reductions. For eight strategies, an estimated range of potential additional statewide water benefits by 2030 is quantified. Water supply benefits and estimates are shown as dots and ranges in the second column of Table 1-2. The table shows that considerable capacity exists to benefit water supply among the eight strategies. In some cases, the values represent a local or regional benefit and may not provide statewide benefits. In addition, implementing some strategies, such as water-dependent recreation or ecosystem restoration, may increase total water demands. The water benefits of many strategies were not quantified because the potential for additional water supply is either incidental (small) or has not yet been estimated statewide. Also, some strategies do not produce water supply benefits.

Table 1-3 includes unit cost information for selected RMSs. Generally, the unit cost information is based on surveys of local projects.

PLACEHOLDER Table 1-3 Range of Strategy Unit Costs

[Any draft tables, figures, and boxes that accompany this text for the public review draft are included at the end of this chapter.]

The information and data in Table 1-3 and the Volume 3 strategy narratives should be treated as preliminary indicators of the scale and type of statewide potential benefits and associated costs. In most cases, assumptions and methodologies are unique to given strategies, and neither benefits nor costs are additive among different strategies. The costs, benefits, and impacts of actually implementing these strategies in project-specific locations could vary significantly, depending on local objectives and project-level complexities. Project-level considerations include the extent of the management strategies already incorporated into the existing system; proposed locations of new strategies, operations, mitigation, and system integration; and the presence of cultural or environmental resources. Therefore, local and regional water management efforts should develop their own estimate of costs and potential benefits, as well as other trade-offs associated with the application of any particular strategy or package of strategies.

Table 1-1 Resource Management Strategies and Management Objectives

Reduce Water Demand	Improve Water Quality
Agricultural Water Use Efficiency	Drinking Water Treatment & Distribution
Urban Water Use Efficiency	Groundwater / Aquifer Remediation
Improve Operational Efficiency & Transfers	Matching Quality to Use
Conveyance – Delta	Pollution Prevention
Conveyance – Regional / Local	Salt & Salinity Management
System Reoperation	Urban Stormwater Runoff Management
Water Transfers	Practice Resource Stewardship
Increase Water Supply	Agricultural Land Stewardship
Conjunctive Management & Groundwater	Ecosystem Restoration
Desalination — Brackish & Seawater	Forest Management
Precipitation Enhancement	Land Use Planning & Management
Recycled Municipal Water	Recharge Areas Protection
Surface Storage – CALFED	Sediment Management*
Surface Storage – Regional/Local	Watershed Management
Improve Flood Management	People & Water
Flood Management	Economic Incentives (Loans, Grants, & Water Pricing)
Other Strategies	Outreach and Education*
Crop idling, dew vaporization, fog collection, irrigated land retirement, rainfed agriculture, and waterbag transport	Water and Culture*
	Water-Dependent Recreation

Note:

* New resource management strategies for *California Water Plan Update 2013*

Table 1-2 Resource Management Strategy Summary

	Potential Strategy Benefits ¹											Accumulated Cost by 2030 (\$ Billion) ²	
	Water Supply Benefits by 2030 ² (million acre-feet/year)	Reduce Drought Impacts	Improve Water Quality	Higher Operational Flexibility & Efficiency	Reduce Flood Impacts	Environmental Benefits	Energy Benefits	More Recreational Opportunities	Reduce Groundwater Overdraft	Improve Food Security	Public Safety & Emergency Response		
Reduce Water Demand													
Agricultural Water Use Efficiency	O	0.1 – 1.0 ³		O	O		O				O	0.3 – 0.5	
Urban Water Use Efficiency	O	1.2 – 3.1	O	O	O		O	O				2.5 – 6.0	
Improve Operational Efficiency & Transfers													
Conveyance — Delta	O	N/A	O	O	O	O	O		O	O	O	O	1.2 – 17.2
Conveyance — Regional / Local	O	N/A	O	O	O	O	O			O	O		N/A
System Reoperation	O	N/A	O	O	O	O	O	O		O		O	N/A
Water Transfers	O	N/A	O		O		O				O		N/A
Increase Water Supply													
Conjunctive Management & Groundwater	O	0.5 – 2.0	O	O	O	O	O			O	O		N/A
Desalination — Brackish Water & Seawater	O	0.3 – 0.4	O	O		O				O			2.0 – 3.0
Precipitation Enhancement	O	0.3 – 0.4						O					0.1 – 0.2
Recycled Municipal Water	O	1.8 – 2.3	O		O			O					6.0 – 9.0
Surface Storage – CALFED	O	0.1 – 1.1	O		O	O			O	O	O		0.7 – 9.2
Surface Storage – Regional / Local	O	N/A	O	O	O	O		O	O	O	O		N/A
Improve Flood Management													
Flood Management	O	N/A	O	O		O	O			O		O	32 – 100
Improve Water Quality													
Drinking Water Treatment & Distribution	O	N/A	O	O									44.5
Groundwater / Aquifer Remediation	O	N/A		O							O		20.0

	Potential Strategy Benefits ¹											Accumulated Cost by 2030 (\$ Billion) ²
	Water Supply Benefits by 2030 ² (million acre-feet/year)	Reduce Drought Impacts	Improve Water Quality	Higher Operational Flexibility & Efficiency	Reduce Flood Impacts	Environmental Benefits	Energy Benefits	More Recreational Opportunities	Reduce Groundwater Overdraft	Improve Food Security	Public Safety & Emergency Response	
Matching Quality to Use	O	N/A	O	O	O	O				O		0.1
Pollution Prevention	O	N/A		O		O	O	O	O		O	21.0
Salt & Salinity Management	O	N/A		O	O		O	O				> 10.0
Urban Stormwater Runoff Management	O	N/A	O	O	O	O	O	O	O		O	3.8
Practice Resource Stewardship												
Agricultural Land Stewardship	O	N/A	O	O		O	O	O	O	O		5.3
Ecosystem Restoration	O	N/A	O	O	O	O	O	O	O		O	N/A
Forest Management	O	0.1 – 0.5 ⁴	O	O		O	O	O	O		O	0.3 – 0.8
Land Use Planning & Management	O	N/A	O	O		O	O	O		O	O	N/A
Recharge Area Protection	O	N/A	O	O	O	O				O	O	N/A
Sediment Management*	O	N/A		O	O	O	O				O	N/A
Watershed Management	O	N/A	O	O	O	O	O	O	O	O		0.5 – 3.6
People & Water												
Economic Incentives (Loans, Grants & Water Pricing)	O	N/A	O		O		O					N/A
Outreach and Education*			O			O	O	O			O	N/A
Water & Culture							O			O		N/A
Water-Dependent Recreation						O	O			O		N/A
Other — subsidiary or emerging												
Various strategies	Objectives vary by strategy											N/A
Innovation Actions and Essential Support Activities ⁵												
Improve governance & decision-making (regionally focused)												N/A
Improve planning processes & public engagement												N/A
Strengthen government agency alignment (plans, policies, & regulations)												N/A

	Potential Strategy Benefits ¹											Accumulated Cost by 2030 (\$ Billion) ²
	Water Supply Benefits by 2030 ² (million acre-feet/year)	Reduce Drought Impacts	Improve Water Quality	Higher Operational Flexibility & Efficiency	Reduce Flood Impacts	Environmental Benefits	Energy Benefits	More Recreational Opportunities	Reduce Groundwater Overdraft	Improve Food Security	Public Safety & Emergency Response	
Advance information technology (data & analytical tools)												N/A
Advance water technology & science (research & development)												N/A

Notes:

N/A = unavailable.

¹ Actual resource management strategy (RMS) benefits will depend on how strategies are implemented. The water supply benefits are not additive. Although presented individually, the RMSs are alternatives that can complement each other or compete for limited system capacity, funding, water supplies, or other components necessary for implementation. Assumptions, methods, data, and local conditions vary per strategy.

² Additional cost information is found in the RMS narratives and Volume 5, *Technical Guide*. Unit cost information for select RMSs is found in Table 1-3 of Volume 3.

³ Value is Net Water to account for water reuse among agricultural water users.

⁴ Numbers are for meadow restoration only.

⁵ Innovation actions are essential for successfully integrating packages of the RMSs, and their effective and efficient implementation. The cost of innovation actions is noticeably small as compared with the cost of implementing the RMSs and their associated grey and green infrastructure (see Chapters 2 and 7 of Volume 1 for more on investing in innovation and infrastructure).

Table 1-3 Range of Strategy Unit Costs

Unit Cost Information for Selected California Water Plan Update 2013 Resource Management Strategies	
Resource Management Strategy	Range of Costs (Dollars/Acre-Foot)
Agricultural Water Use Efficiency	\$85-\$675
Brackish Groundwater Desalination	\$500-\$900
Meadow Restoration	\$100-\$250
Ocean Desalination	\$1,000-\$2,500
Municipal Recycled Water	\$300-\$1,300
Surface Storage	\$300-\$1,100
Urban Water Use Efficiency	\$223-\$522
Wastewater Desalination	\$500-\$2,000

